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Chris P. Tsokos

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FINAL REPORT

Research Accomplishments

During 1979-80 Under Contract

AFSOR - P.R. - 79 - 00974

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{handwritten: The Development of Some Stochastic Models of mathematical Sciences}

The research accomplishments under the present contract fall
in three areas of mathematical sciences. These areas are in
nonparametric probability estimation, environmental problems, and
reliability modelings.

Utilizing the theory of sample characteristics functions
and the Fourier representation of the kernel estimator, we have
derived rates of convergence for kernel estimators in a large class
of Hilbert spaces.

Preliminary results have been obtained on two unresolved
problems in the area of penalized maximum-likelihood estimators.
The first problem we dealt with is developing the consistency
conditions of such estimators. The second accomplishment was the
development of an objective criterion for choosing a smoothness
parameter.

Kernel estimators of a probability density function with
variable bandwidths that depend on the distance to the first
through n^{th} neighbors of the point in question were studied. The
asymptotic properties and rates of convergence of these types of
bandwidths were obtained .

A deterministic model that involves the phytoplankton production in a marine ecosystem was developed along with its stochastic analysis.

A nutrient limited model for phytoplankton production was simulated and the mean behavior of the random process as well as the variance and correlation structure were studied.

The Gompertz probability distribution was studied as a reliability failure model. Estimation of its parameters can not be obtained in closed form. A numerical procedure has been developed to obtain acceptable estimates of the parameter. Also, other forms such as the Makeham-Gompertz distribution were studied.

The following papers were written:

1) Recent Developments in Nonparametric Estimation of Probability Density, Stochastic Systems, Academic Press, N.Y., N.Y., with A. Rust.

2) Nonparametric Estimation of Probability Density Function, submitted, with A. Rust.

3) On Maximum-Penalized Likelihood Estimators, submitted, with A. Rust.

4)   Developments in Nonparametric Density Estimation
     Methods, Internal Statistics Institute, with S. Bean.

5)   Variable Kernel Estimates of a Probability Density
     Function, submitted, with S. Bean.

6)   Phytoplankton Modeling Involving Random Rate Constants,
     Part I: International Journal of Environmental Studies,
     with R. Jernigan.

7)   Phytoplankton Modeling Involving Random Rate Constants,
     Part II: International Journal of Environmental Studies,
     with R. Jernigan.

8)   A Linear Stochastic Model for Phytoplankton Production
     in a Marine Ecosystem, Journal of Ecological Modeling,
     with R. Jernigan.

9)   Simulation of a Nonlinear Stochastic Ecology Model,
     Journal of Applied Mathematics and Computation, with
     R. Jernigan.

10) Maximum Likelihood Estimators of Bivariate Distribution
     with Monotone Failure Rates, with A.N.V. Rao.